PIMA CO. AZ GIS LINEAR REFERENCING SYSTEM (LRS) DYNAMIC SEGMENTATION (DYNSEG)

AGIC 2009, Tucson, AZ
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Topics

- LRS / DynSeg Basics & Uses
- Pima County's LRS / DynSeg Setup & Processes
- Demo
- Lessons Learned & Challenges

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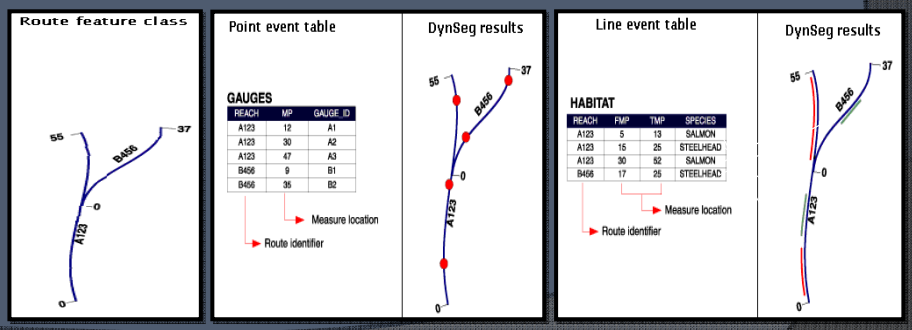
LRS / DynSeg Overview

- Linear Referencing (LRS)
  - Is the term used to describe the methodology for storing, transferring and displaying data using a route layer and measures.
- Dynamic Segmentation (DynSeg)
  - Is the process of computing and displaying the location of events in an event table.

LRS / DynSeg: The Basics

- Need:
  - Route
  - Reference location
  - Events stored in tabular form

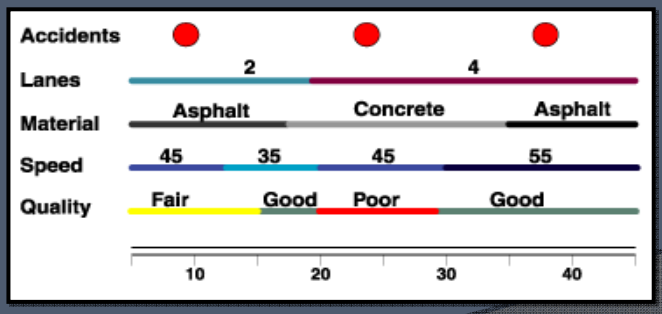


Why Use LRS / DynSeg?

- Standardized data collection
  - Between Multiple Jurisdictions
- Simplifies storage of data
  - Eliminates segmenting original street network
  - Reduced editing time

Linear Referencing Applications

- Features with frequently segmented data
- Modeling one to many (1:M) relationships



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Pima County's LRS/DynSeg

- Purpose: Stop breaking up the street network
- Why?
  - Wanted edits to street network to key all changes needed for LRS/DynSeg
- How?
  - 'Intersection' Based
  - Several different features classes used in concert to satisfy the Big 3 Needs
    - Had to account for unique configuration of street network

PC's LRS/DynSeg:

- Reference segment – Route from street network (and exceptions)
- Reference location – 'Intersections' or Cross streets
- Event features plotted 'from' reference location (& offset distance), 'to' reference location (& offset distance)

Route – Broadway BL
Cross Streets – Kolb RD & Wilmot RD

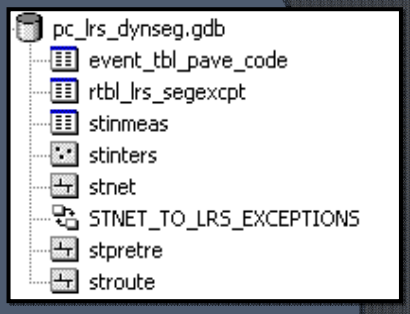
FROM end = Wilmot RD

TO end = Kolb RD

TOFFDIST = -24 from TO end

Data Components

- Route :
  - STNET
  - RTBL_LRS_SEGEXCPT
  - STPRERTE
  - STROUTE
- Intersections or Cross Streets :
  - STINTERS
  - STINTMEAS
- Events :
  - Event table

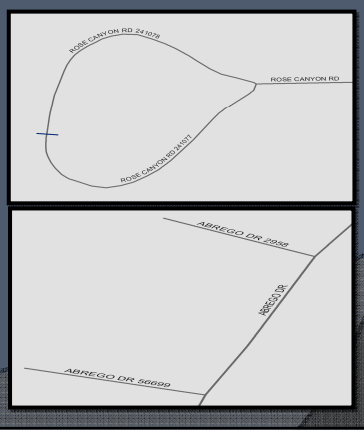


ROUTE

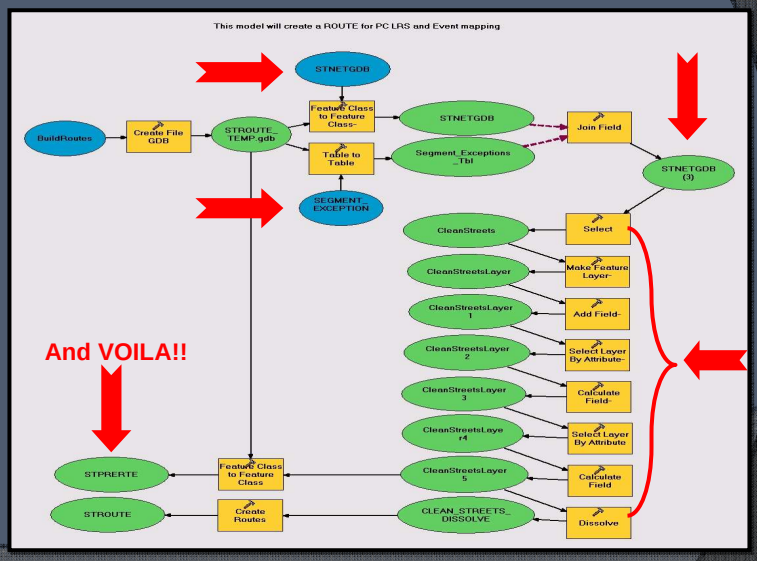
- STNET = Maintained road network
- RTBL_LRS_SEGEXCPT = Exceptions table that flags funky segments
  - FK Join ROADID to STNET
- STPRERTE = Streets with exceptions accounted for
- STROUTE = routed STPRERTE

ROADID *	EXCEPTION_TYPE
241077	LOOP
241078	LOOP
2958	KNUCKLE
56699	KNUCKLE

Segment Exceptions Related Table



Model that creates ROUTE



Intersections or Cross Streets

- STINTERS = Polyline endpoints from STNET
- STINTMEAS = table with M values along STROUTE at STINTERS (except end of road)
- Some necessary attributes in STINTMEAS to handle 'Duplicate' Intersections
  - Example: Loops, Different Jurisdictions (Ajo and City of Tucson), Zig Zag, etc

Intersections or Cross Streets

- STINTMEAS as a View provides the Reference Location for events
  - Measure along STROUTE
  - CRSTR_LINK is the FK Join
- Necessary Attributes :
  - CROSSTREET – Simple cross street ID
  - The STINTERID is appended when referencing Dup Intersection

RID	CROSSTREET	MEAS	COUNTER	STINTERID	CRSTR_LINK	X_COORD	Y_COORD
VAIL VIEW RD 54080	VAIL VIEW RD	0.00000000	1	7404	VAIL VIEW RD	1073335.6...	354462.1...
BROADVIEW DR	VAIL VIEW RD	2764.18600000	2	41411	VAIL VIEW RD 41411	1073244.4...	355000.9...
VAIL VIEW RD	BROADVIEW DR	2598.95100000	2	41411	BROADVIEW DR 41411	1073244.4...	355000.9...
SAHUARITA RD	VAIL VIEW RD	88008.48600000	1	20228	VAIL VIEW RD	1073199.4...	352418.0...
VAIL VIEW RD	SAHUARITA RD	0.00000000	1	20228	SAHUARITA RD	1073199.4...	352418.0...
IRIS PL	VAIL VIEW RD	0.00000000	2	14063	VAIL VIEW RD 14063	1073251.3...	352955.1...

Event Data Table Fields

(All manual entry)

- ROUTE_ID - route that the event is on
- FCRSTR - from cross street name
- FINTID – FROM STINTERID for duplicate intersections
- FOFFDIST - distance from the FCRSTR
- TCRSTR - to cross street name
- TINTID – TO STINTERID for duplicate intersections
- TOFFDIST - distance from the TCRSTR
- OFFSET (only if applicable) – used to display event on either side of route

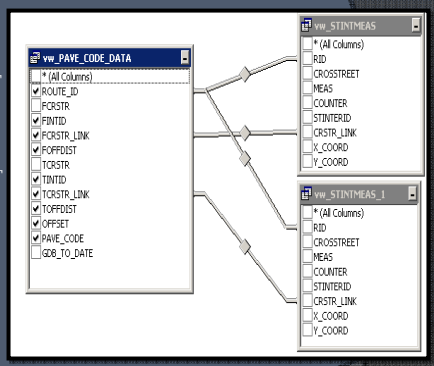
View for Event Data Table

- Created to concatenate user entered fields so it can be joined to STINTMEAS View

ROUTE_ID	FCRSTR	FINTID	FCRSTR_LINK	FOFFDIST	TCRSTR	TINTID	TCRSTR_LINK	TOFFDIST	OFFSET	PAVE_CODE	GDB_TO_DATE
3RD ST	MCKINLEY AV	90477	MCKINLEY AV 90477	0.00000000	2ND AV	113592	2ND AV 113592	0.00000…	NULL	1	12/31/9999 12:…
40TH ST	ALVERNON WY	0	ALVERNON WY	-630.521…	ALVERNON WY	0	ALVERNON WY	0.00000…	NULL	1	12/31/9999 12:…
43RD PL	DODGE BL	0	DODGE BL	0.00000000	DODGE BL	0	DODGE BL	691.439…	NULL	1	12/31/9999 12:…
44TH ST	DODGE BL	59442	DODGE BL 59442	0.00000000	DODGE BL	59442	DODGE BL 59442	938.504…	NULL	1	12/31/9999 12:…
44TH ST	PALO VERDE RD	0	PALO VERDE RD	0.00000000	DODGE BL	59441	DODGE BL 59441	0.00000…	NULL	1	12/31/9999 12:…

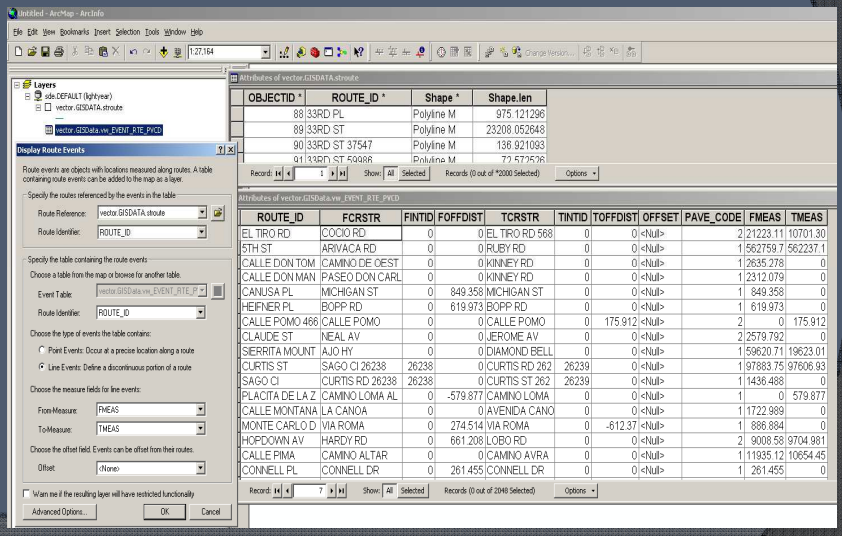
Create Final Event Table

- Join Event Data View and STINTMEAS View
- Calculate FMEAS:
  - vw_STINTMEAS.MEAS + vw_PAVE_CODE_DATA.FOFFDIST
- Calculate TMEAS:
  - vw_STINTMEAS_1.MEAS + vw_PAVE_CODE_DATA.TOFFDIST



ROUTE_ID	FCRSTR	FINTID	FOFFDIST	TCRSTR	TINTID	TOFFDIST	OFFSET	PAVE_CODE	FMEAS	TMEAS
TRICO RD	AVRA LN 18063	18063	0.00000…	AVRA VALLEY RD 1546	1546	0.00000000	NULL	1	50170.22…	52850.88…
COLUMBUS BL	DAWSON RD 42746	42746	0.00000…	CAMINO ANTIGUA	0	0.00000000	NULL	1	2584.506…	0.00000000
SANTA RITA RD	DAWSON RD	0	-2198.62…	SWEET GRASS TR	0	3091.412…	NULL	1	12413.93…	26932.38…
KATHIE ANN PL	KATHIE ANN DR	0	0.00000…	KATHIE ANN DR	0	-171.910…	NULL	1	171.9100…	0.00000000
FARINO PL	DAVIDSON RD	0	-630.962…	DAVIDSON RD	0	0.00000000	NULL	1	0.00000000	630.9620…
MICHELLE PL	SONYA WY	0	0.00000…	SONYA WY	0	1101.254…	NULL	1	0.00000000	1101.254…

Display Route Event Table in ArcMAP



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Challenges

- Issues
  - Unique physical aspects of the street network
  - Data Structure
  - Event mapping process
- Challenges
  - Rules and allowances to realize the advantage of single edits with dynamic consequences – esp. across jurisdictions
  - Converting data resources
  - Converting human resources

Lessons Learned

- LRS / DynSeg is not a plug and play environment
- Typical street network configuration is not route creation friendly
- Limited reference information on LRS / DynSeg
- Many flavors of setup
- Nightly processes play a big role

Pima County Applications

- Our status Today
  - What layers we use it on
    - Pavement Management - CarteGraph
    - Federal Highway Administraion (FHWA)
    - Speed Limits
    - Maintenance Agreements
    - Number of Lanes
    - Major Streets & Scenic Routes
  - Level of adoption
- Road Ahead

Final Thoughts

- Goal was to have an environment that would be dynamic; allowing typical day to day edits to occur once while supporting mapping for many referenced phenomena automatically …
- We did that, and better yet, it appears to work!
- It wasn't hard, but it was time consuming and an adventure in problem solving.

Thanks!

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